

## **Space Effects on Air Force Systems**

**W. Jeffrey Hughes**

**Boston University  
Center for Space Physics  
725 Commonwealth Ave  
Boston, MA 02215-1401**

**2 May 2000**

**Scientific Report No. 1**

**APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.**

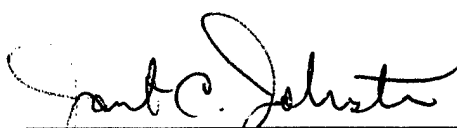


**AIR FORCE RESEARCH LABORATORY  
Space Vehicles Directorate  
29 Randolph Rd  
AIR FORCE MATERIEL COMMAND  
Hanscom AFB, MA 01731-3010**

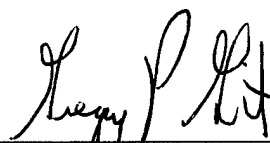
---

**20020816 075**

"This technical report has been reviewed and is approved for publication"



JANET C. JOHNSTON  
Contract Monitor



GREGORY P. GINET  
Space weather Center of Excellence

This report has been reviewed by the ESC Public Affairs Office (PA) and is releasable to the National Technical Information Service (NTIS).

Qualified requestors may obtain additional copies from the Defense Technical Information Center (DTIC). All others should apply to the National Technical Information Service (NTIS).

If your address has changed, if you wish to be removed from the mailing list, or if the addressee is no longer employed by your organization, please notify AFRL/VSIM, 29 Randolph Road, Hanscom AFB MA 01731-3010. This will assist us in maintaining a current mailing list.

Do not return copies of this report unless contractual obligations or notices on a specific document require that it be returned.

# REPORT DOCUMENTATION PAGE

Form Approved

GSA GEN. REG. NO. 27

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank) 2. REPORT DATE  
May 2000

3. REPORT TYPE AND DATES COVERED  
Scientific Report #1

4. TITLE AND SUBTITLE  
Space Effects on Air Force Systems

5. FUNDING NUMBERS  
PE: 35160F  
PR: 2822  
TA: GC  
WU: BU

6. AUTHOR(s)  
W. Jeffrey Hughes

Contract: F19628-99-C-0028

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)  
Boston University  
Center for Space Research  
725 Commonwealth Avenue  
Boston, MA 02215-1401

8. PERFORMING ORGANIZATION  
REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)  
Air Force Research Laboratory/VSBX  
29 Randolph Road  
Hanscom AFB MA 01731-3010

10. SPONSORING/MONITORING  
AGENCY REPORT NUMBER

AFRL-VS-TR-2000-1544

Contract Manager: Janet Johnston, VSBX

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION STATEMENT

Approved for public release; Distribution unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

This report outlines the new and innovative technical work carried out by Boston University for the development of a novel, reliable space imaging experiment and to enhance the reliability of instrumentation to be launched that will measure space plasma parameters.

Coronal imager  
Plasma detector

Solar mass ejections

14. NUMBER OF PAGES

15. SUBJECT CODE

UNCLASSIFIED

UNCLASSIFIED

UNCLASSIFIED

SAR

## **I. Introduction**

This contract funds a comprehensive 48 month period for developing a novel, reliable space imaging experiment and to enhance the reliability of instrumentation to be launched that will measure space plasma parameters. The primary task will involve overseeing the design, fabrication, testing, calibration, integration and early orbit operations activity for the Solar Mass Ejection Imager (SMEI). SMEI will be used to demonstrate forecasting of solar and interplanetary conditions, which cause geomagnetic disturbances. A smaller task will involve analysis of preflight integration test data and prelaunch technical support for the SSIES-2 and SSIES-3 Plasma Wave Instruments. The Plasma Wave Instruments will further the understanding of the characteristics of space plasma.

## **II. Work Undertaken This Year**

### **(a) Solar Mass Ejection Imager Development**

Mr. Anderson concluded his second year on this contract functioning as the SMEI system engineer on the Coriolis Mission. This date also coincides with the completion of the second year of the Coriolis spacecraft bus contract. Over the past year, he has provided technical expertise that has lead to the successful conclusion of the developmental phase of the program and of the environmental testing of the SMEI experiment. Each of the past four reporting periods outlining his accomplishments is as follows:

Report 1.) Mr. Anderson, functioning as the SMEI system engineer on the Coriolis Mission, provided technical expertise for interfacing the SMEI experiment with the Coriolis spacecraft bus to the design staff at Spectrum Astro, Gilbert, AZ. Also, he provided technical inputs to the Coriolis Integrated System Test Plan and inputs for the Interface Change Notices issued on the Interface Control Document to Spectrum Astro. As the SMEI Point of Contact, he coordinated many activities such as the weekly telecons, interface design activities, schedules, preparation of other miscellaneous documents, tracking of open action items, etc. He also maintained the engineering file system and oversaw the development activities at the University of Birmingham, Birmingham, UK. He traveled to the University of Birmingham to assist with the integration and testing of four flight optical systems (baffles and optics). Also, he attended the Coriolis Ground System preliminary design review and the Mission Operations Working Group #5 meeting at the Naval Research Laboratory, Washington, DC.

Report 2.) Mr. Anderson, functioning as the SMEI system engineer on the Coriolis Mission, provided technical expertise for interfacing the SMEI experiment with the Coriolis spacecraft bus to the design staff at Spectrum Astro, Gilbert, AZ. Also, he provided technical inputs for the development of the Camera alignment procedure and reviewed the space vehicle System Test Plan. He also supported the Engineering Model Data Handling Unit shock test and participated with the static loads review. He

developed look-up tables for the thermistor State Of Health telemetry outputs. As the SMEI Point of Contact, he coordinated many activities such as the weekly telecons, interface design activities, schedules, preparation of other miscellaneous documents, tracking of open action items, etc. He also maintained the engineering file system and oversaw the development activities at the University of Birmingham, Birmingham, UK. He traveled to Spectrum Astro in Gilbert, AZ for the Engineering Model Data Handling Unit 1553 Compatibility Test, to attend the Ground System Interface Control Document and to attend the Mission Operations Working Group #6 meeting. He also traveled to National Test Systems in Phoenix, AZ to support the Engineering Model Data Handling Unit shock test.

Report 3.) Mr. Anderson, functioning as the SMEI system engineer on the Coriolis Mission, provided technical expertise for interfacing the SMEI experiment with the Coriolis spacecraft bus to the design staff at Spectrum Astro, Gilbert, AZ. Also, he provided technical expertise for the Camera alignment procedure and reviewed the draft test report. He also reviewed various space vehicle System Test Plans and Procedures. As the SMEI Point of Contact, he coordinated many activities such as the weekly telecons, interface design activities, schedules, preparation of other miscellaneous documents, tracking of open action items, etc. He also maintained the engineering file system and oversaw the fabrication and test activities at the University of Birmingham, Birmingham, UK. He traveled to the University of Birmingham to provided technical support during the pre-environmental calibration and for optical alignment verification on each of the four SMEI Cameras (3 flight and 1 spare).

Report 4.) Mr. Anderson, functioning as the SMEI system engineer on the Coriolis Mission, provided technical expertise for interfacing the SMEI experiment with the Coriolis spacecraft bus to the design staff at Spectrum Astro, Gilbert, AZ. Also, he provided technical expertise during the review of various space vehicle System Test Plans and Procedures. As the SMEI Point of Contact, he coordinated many activities such as the weekly telecons, schedules, preparation of other miscellaneous documents, tracking of open action items, etc. He also monitored the environmental test activities at the University of Birmingham, Birmingham, UK. In support of these tests, he traveled to the University of Birmingham to provided technical support during the Camera thermal vacuum tests and again for the final (post environmental) calibration and for optical alignment verification measurements on each of the four SMEI Cameras (3 flight and 1 flight spare).

(b) DMSP Plasma Monitoring System Support

Mr. Anderson concluded his second year on this contract providing technical support to the DMSP SSIES-2 and SSIES-3 instruments. Over the past year, he has provided technical expertise. He has provided technical expertise and support in analyzing test data from several of the integration tests taken on the S17 and S20 spacecrafts. Each of the past four reporting periods outlining his achievements is as follows:

Report 1.) Mr. Anderson provided technical support for the SSIES-3 Plasma Wave Instruments on the S16 – S20 DMSP spacecrafts. He reviewed the S20 Go/NoGo test data taken at the Payload Integration Test Facility, Vandenberg, CA.

Report 2.) Mr. Anderson provided technical support for the SSIES-3 Plasma Wave Instruments on the S16 – S20 DMSP spacecrafts. He reviewed Go/NoGo test data taken on the S17 and S20 spacecrafts. The S17 spacecraft is being prepared for storage at Lockheed Martin Missiles and Space in Sunnyvale, CA and the S20 spacecraft is being processed for launch at the Payload Integration Test Facility in Vandenberg AFB, CA.

Report 3.) Mr. Anderson provided technical support for the SSIES-3 Plasma Wave Instruments on the S16 – S20 DMSP spacecrafts. He reviewed Go/NoGo test data taken on the S17 and S20 spacecrafts. The S17 spacecraft is being prepared for storage at Lockheed Martin Missiles and Space in Sunnyvale, CA and the S20 spacecraft is being processed for launch in January 2001 at the Payload Integration Test Facility in Vandenberg AFB, CA.

Report 4.) Mr. Anderson provided no technical support for the SSIES-3 Plasma Wave Instruments on the S16 – S20 DMSP spacecrafts. The S20 spacecraft was scheduled for launch in January 2001 at Vandenberg AFB, CA; however, the launch vehicle and spacecraft both experienced difficulties and the launch had to be scrubbed. Launch is now anticipated to be in the next quarter.

### **III. Plans For The Next Year**

#### **(a) Solar Mass Ejection Imager Development**

Mr. Anderson will monitor the SMEI flight system pre-delivery events at the University of Birmingham, UK and during the delivery process to Spectrum Astro in Gilbert, AZ. After delivery, he will provide technical support for the Coriolis spacecraft integration activities at Spectrum Astro. He will also continue to provide technical support to Spectrum Astro for establishing the Coriolis spacecraft interface test software and documentation. Also, he will continue to provide technical support to the Mission Operations group at Research Development Test & Evaluation Support Complex, Kirtland AFB, NM (RSC) and he will be attending the Mission Operations Working Group Meeting #8 in May 2001.

#### **(b) DMSP Plasma Monitoring System Support**

Mr. Anderson will also continue to provide technical support for integrating and testing the plasma instruments on the DMSP S16 - S20 spacecrafts. He will be reviewing test data from scheduled integration tests on the S16 - S20 spacecrafts and will provide pre-launch support for the S20/F16 spacecraft.

#### **IV. Travel**

Mr. Anderson represented SMEI on 9 occasions at technical interface meetings and functions. He had no DMSP travel during the past year. Each trip is summarized below:

On 9 May - 18 May 2000, Peter Anderson traveled to the University of Birmingham, UK to assist with the integration and testing of four flight optical systems. The cost of this trip (\$2,953.53) was charged to the contract.

On 26 - 28 June 2000, Peter Anderson traveled to the Naval Research Laboratory to attend the Coriolis Mission Operations Ground System PDR and Mission Working Group (MOWG) #5 meeting. The cost of this trip (\$671.69) was charged to the contract.

On 9 July - 16 July 2000, Peter Anderson traveled to Spectrum Astro, Inc., Gilbert, AZ to assist with the Engineering Model Data Handling Unit 1553 Compatibility Test. The cost of this trip (\$1,670.56) was charged to the contract.

On 19 July - 22 July 2000, Peter Anderson traveled to Spectrum Astro, Inc., Gilbert, AZ and National Test Systems, Phoenix, AZ for the Engineering Model Data Handling Unit shock test. The cost of this trip (\$1,064.41) was charged to the contract.

On 25 September - 29 September 2000, Peter Anderson traveled to the Research Development Test & Evaluation Support Complex, Kirtland AFB, NM to attend The Ground System Interface Control Document review and the Mission Operations Working Group #6 meeting. The cost of this trip (\$1205.12) has been charged to the contract.

On 29 October 2000 - 8 November 2000, Peter Anderson traveled to the University of Birmingham in the United Kingdom to provide technical support with the pre-environmental calibration and optical alignment verification on each of the four SMEI Cameras (3 flight and 1 spare). The cost of this trip (\$2863.78) was charged to the contract.

On 11 January 2001 - 12 January 2001, Peter Anderson traveled to Spectrum Astro, Inc., Gilbert, AZ to the Mission Operations Working Group #7 Meeting. The cost of this trip (\$754.59) was charged to the contract.

On 13 January 2001 - 18 January 2001, Peter Anderson traveled to the University of Birmingham in the United Kingdom to provide technical support with the thermal vacuum tests involving the SMEI Cameras. The cost of this trip (\$1,238.67) has not been submitted; however, it will be charged to the contract during the next reporting period.

On 05 March 2001 - 09 March 2001, Peter Anderson traveled to the University of Birmingham in the United Kingdom to provide technical support with the final (post environmental) calibration and optical alignment verification measurements on each of the four SMEI Cameras (3 flight and 1 flight spare). The cost of this trip (\$1,315.30) has

not been submitted; however, it will be charged to the contract during the next reporting period.

#### **IV. Personnel**

The Principal Investigator for this project is Prof. W. Jeffrey Hughes. A small percentage of his salary was charged to the contract this past year. Mr. Peter Anderson, System Engineer, was supported 100% by this project this past year.

#### **VI. Publications**

There were no publications arising from this contract this past year.